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Original research

The prevalence of refractive errors in 5–15 year-old population of two underserved rural areas of Iran

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Abstract

Purpose: To determine the prevalence of hyperopia and myopia and their associations with age and gender in 5- to 15-year-old children in underserved rural areas in Iran.
Methods: In this cross-sectional study, sampling was done using a multistage cluster sampling method from two underprivileged rural regions in Iran, and 3851 persons over 1 year old of age were invited to the study. After inviting the selected participants, examinations were conducted at a designated site in the selected villages. All participants underwent measurements of uncorrected and corrected visual acuity, manifest refraction, and a slit-lamp examination. Cycloplegic refraction was done by instilling cyclopentolate 1% eye drops in under 15-year-old participants.
Results: Of the 3851 selected persons, 3314 subjects participated (86.5%), and of these, 602 were in the 5–15 year age group. The prevalence of myopia and hyperopia in the studied children was 2.60% [95% confidence interval (CI): 1.10–4.10] and 4.00% (95% CI: 1.84–6.15), respectively. The prevalence of myopia in male and female children was 2.65% and 2.55%, respectively ($P = 0.951$). The prevalence of hyperopia in male and female children was 2.83% and 5.25%, respectively ($P = 0.130$). The prevalence of myopia in the villages of southwest and north was 2.42% and 3.09%, respectively ($P = 0.618$), and the prevalence of hyperopia was 4.71% and 2.10%, respectively ($P = 0.0056$).
Conclusion: The present report is a brief description of the status of refractive errors in children residing in underprivileged villages of two rural districts in Iran. As presented, the prevalence of myopia is not high, although the prevalence of hyperopia is in the mid-range compared to previous studies.

Keywords: Myopia; Hyperopia; Cross-sectional study; Rural population; Children

Introduction

Refractive errors are the leading cause of visual impairment in the world and account for a great share of visual impairment. A review in 2010 by Naidoo stated that 6.8 million people in the world are blind due uncorrected refractive errors, and 101.2 million are visually impaired.[1] Refractive errors are vision disorders that can affect an individual throughout their

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lifetime, and they are the most common vision problem in most age groups. Children are one of the most important populations at risk of refractive errors, and such visual problems can impact their learning experiences and future occupational opportunities.

Over the past two decades, the distribution of refractive errors in children around the world has been an issue of interest. In 2000, a report by Negrel on refractive errors presented a protocol for determining refractive errors in children.[2] According to this protocol, refractive errors in 5–15-year-old children should be measured under cycloplegia. Since then, numerous studies around the world have based their work on this protocol to describe the prevalence of refractive errors in children.[2–17] Although we expect a higher prevalence of hyperopia in children, a review of these study results suggests that myopia can be more common than hyperopia, and there is agreement that myopia is more common in East Asian populations.[2–16]

In Iran, the protocol for refractive errors in children was first followed by Fotouhi et al to determine the prevalence of refractive errors in children in Dezful,[12] and since then, several other studies in various parts of Iran have described refractive errors using the same protocol.[3,5,12] However, except for the study by Fotouhi et al whose samples were partly selected from rural areas,[12] all other reports from Iran concern urban children. Overall, studies on rural populations are less common throughout the world.[7,8,11,13,18] Given their less access to health services, it is essential to direct attention to rural populations. The present report is part of a larger study conducted at underprivileged rural areas in Iran. Given the limited number of reports from rural areas and the importance of children's visual status, the purpose of the present report is to describe the prevalence of refractive errors in rural children.

Methods

Sampling method

The present study was conducted cross-sectionally in 2015. In this study, the residents of deprived villages were considered as the target population, and it was conducted at rural areas of two underprivileged districts in Iran. For sampling, a multistage cluster sampling approach was applied to select potential participants. One of the offices of the presidential administration in Iran is dedicated to the development of rural and deprived areas of the country. The sampling frame of the present study was based on the roster of deprived rural villages provided by this office. For this purpose, national data was used to randomly select two districts from the north and southwest of the country. The district selected from the north was Kajour (a district of Noshahr County, Mazandaran Province), and the selected district from the southwest was Shahyoun (a district of Dezful County, Khuzestan Province). In the next stage, rosters of all villages in these two districts were prepared, and a number of them were randomly selected.

Since a main objective of this survey was to evaluate visual impairment, the sample size was calculated based on the prevalence of visual impairment in a village in Iran. The sample size for a rate of 6.3%, a precision level of 0.01 and a 95% confidence interval (CI) was calculated as 2267. Considering the sampling method, a 1.5 design effect was considered, which corrected the sample size to 3400. Also, a 10% non-response rate was assumed with the total sample size reached 3740. Sampling from each district was proportional to their total population. Therefore, given the sample size calculated for the study, 5 villages were sampled in Kajour and 15 in Shahyoun to maintain the balance, because the latter district had smaller and less populated villages. All over-one-year-old rural-dwellers in each selected village were considered as a study sample and invited to participate in the study.

Examinations in each village were completed at a site with normal room illumination. After obtaining consents and conducting an interview to obtain demographic information, all participants underwent optometric examinations. All optometric examinations were performed by two experienced optometrists. These two optometrists had high inter-examiner agreement on initial testing of uncorrected visual acuity (Interclass Correlation Coefficient (ICC): 0.92) and spherical equivalent of refraction (ICC: 0.90) in 35 subjects.

First, all participants were examined with an auto-refractometer (Nidek ARK-510A Auto Refractor/Keratometer, Japan) to record their objective refraction, and then their uncorrected distance visual acuity (UCVA) was measured using a Snellen E chart at a distance of 6 m. Visual acuity testing for children who were uncooperative with Snellen chart, was done with LEA symbols acuity chart (LEA Symbols Acuity Chart, Good-Lite Company, USA).

In the next stage, after refining the auto-refraction with retinoscopy (Heine Beta 200 retinoscope, HEINE Optotechnik, Germany), all cooperative cases with an UCVA worse than 20/20 were tested for subjective refraction. After the completion of vision tests, all participants had ophthalmic and slit-lamp examinations by an ophthalmologist.

Finally, all participants 15 years of age and younger underwent cycloplegic refraction. For this purpose, a drop of cyclopentolate 1% was instilled in each eye, twice, 5 min apart, and cycloplegic refraction with the auto-refractometer was done 35 min after the last drop.

To allow for proper comparison of our results with other studies using the Negrel's refractive status evaluation protocol for children, participants over 15 years of age and also those under 5 years of age were excluded from this report.

Definitions

Refractive errors were determined based on spherical equivalent refraction. A spherical equivalent of −0.5 diopter (D) or worse was defined as myopia and a spherical equivalent equal to or worse than 2.00 D was defined as hyperopia.

Statistical analysis

The prevalence of myopia and hyperopia are presented as percentages with 95% CI. In calculating the 95% CI, adjustments for the effect of cluster sampling were considered. For

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